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CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA. XX.

THE OUTLINE OF JAPANESE ASCIDIAN FAUNA AS COMPARED WITH THAT OF THE PACIFIC COASTS OF NORTH AMERICA.[1,2)]

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I. The outline of the ascidian fauna of the Japanese waters

The review of the ascidian fauna of the Japanese waters was first made by HARTMEYER* who referred in his paper of 1906 to 43 species including a number of those that were newly established or recorded by himself form the Japanese waters. About thirty years later, the late Prof. Asajirô OKA** made the second review (1935) on Japanese ascidian fauna as he closed his studies on ascidians for about forty years. He mentioned that there were 106 ascidian species known from the Japanese waters and that of these species endemic ones were the most abundant, though 8 arctic and 6 tropical species and 2 cosmopolitans were included. Further he divided the endemic species into two groups, the northern and southern groups; the former comprised the species occurring in the waters surrounding Hokkaido Island and the northern half of Honsyû Island, while the latter consisted of ones living in the waters along the coasts of Kyûsyû and Sikoku Islands and the southern half of Honsyû Island. Cosmopolitans were *Styela plicata* (LESUEUR) and *Ciona intestinals* (LINNAEUS). He paid a special notice to the occurrence of two West-Indian species in the Japanese waters: *Pyura vittata* (STIMPSON) and *Styela partita* (STIMPSON). In that paper he supposed that Japanese ascidian fauna would grow to be about twice as large as that known by him at that time.

Twenty-eight years later, the ascidian fauna of this country is estimated to include 302 taxa that contain 277 distinctly identified species, one allied to a known species, 3 subspecies, 7 varieties and 14 forms as listed below. Here

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1) Contributions from the Seto Marine Biological Laboratory, No. 397.

2) The present work was promoted by the financial aid from the Department of Education.

* HARTMEYER, R. (1906): Ein Beitrag zur Kenntnis der japanische Ascidienfauna. Zool. Anz., Bd. 31, pp. 1-30, text-figs. 1-12.

** OKA, A. (1935): Ueberblick über die japanischen Ascidienfauna. Proc. Imp. Acad., Vol. XI, pp. 198-200.

the area includes the Okhotsk Sea, the Japan Sea and the waters surrounding Tisima (the Kurile Islands), Karahuto (Sakhalin), four main islands of Japan, the Okinawa Islands, Ogasawara (the Bonin Islands), Formosa and Korea.

List I

Ascidians from the Japanese and adjacent waters.
(Compiled on February 8, 1963)

ENTEROGONA
Aplousobranchia (=Krikobranchia)
Family Polyclinidae (=Synoicidae)
Subfamily Polyclininae

1. *Polyclinum constellatum* SAVIGNY, 1816 Japanese waters
2. *Polyclinum saturnium* SAVIGNY, 1816 Sagami Bay, Ôsaka Bay
3. *Polyclinum tsutsuii* TOKIOKA, 1954 Tokara Islands
4. *Aplidiopsis pannosum* (RITTER), 1899 West coast of Kamchatka
5. *Aplidiopsis helenae* REDIKORZEV, 1927 Okhotsk Sea
6. *Aplidiopsis tokaraensis* TOKIOKA, 1954 Tokara Islands
7. *Sidneioides japonense* REDIKORZEV, 1913 Sagami Bay, Nagasaki
8. *Sidneioides snamoti* (OKA), 1927 Sagami Bay, Honsyû Island
9. *Aplidium spitzbergense* HARTMEYER, 1903 Bering Sea

**10. *Aplidium* sp. Hakodate

11. *Macrenteron ritteri* REDIKORZEV, 1927 Bering Sea
12. *Amaroucium glabrum* VERRILL, 1871 Akkesi, Hokkaido Island
13. *Amaroucium constellatum* VERRILL, 1871 Akkesi, Hakodate
14. *Amaroucium dubium* RITTER, 1899 Commander Islands
15. *Amaroucium translucidum* RITTER, 1901 (=*Am. strandi* REDIKORZEV, 1937) Okhotsk Sea, Northern Tisima
16. *Amaroucium fragile* REDIKORZEV, 1927 Okhotsk Sea
17. *Amaroucium polybunum* REDIKORZEV, 1927 Okhotsk Sea
18. *Amaroucium soldatovi* REDIKORZEV, 1937 Okhotsk Sea
19. *Amaroucium pliciferum* REDIKORZEV, 1927 Misaki, Sagami Bay, Ôsaka Bay, Sikoku Island, Kyûsyû Island, Sado
20. *Amaroucium multiplicatum* (SLUITER), 1909 Sagami Bay

**21. *Amaroucium* sp. Sagami Bay, Ôsaka Bay

22. *Amaroucium japonicum* TOKIOKA, 1949 Matoya
23. *Amaroucium yamazii* (TOKIOKA), 1949 Sagami Bay, Kii Sirahama
24. *Amaroucium monotonicum* TOKIOKA, 1954 Tokara Islands
25. *Amaroucium takii* TOKIOKA, 1959 Tyosen Strait
26. *Amaroucium rubrum* TOKIOKA, 1962 Sagami Bay

* *Amaroucium* sp. HARTMEYER (1906) Sagami Bay

27. *Synoicum jacobsoni* REDIKORZEV, 1927 Okhotsk Sea
28. *Synoicum derjugini* REDIKORZEV, 1927 Okhotsk Sea
29. *Synoicum jordani* (RITTER), 1899 Okhotsk Sea
30. *Synoicum cymosum* REDIKORZEV, 1927 Okhotsk Sea
31. *Synoicum pellucens* REDIKORZEV, 1927 Amur Bay (Japan Sea)
32. *Synoicum sabuliferum* REDIKORZEV, 1937 Okhotsk Sea
33. *Synoicum solidum* REDIKORZEV, 1937 Okhotsk Sea
34. *Synoicum parvum* REDIKORZEV, 1937 Okhotsk Sea
35. *Synoicum clavatum* (OKA), 1927 Sagami Bay, Honsyû Island
36. *Synoicum tukusii* TOKIOKA, 1960 Ariake-Kai
37. *Synoicum sagamianum* TOKIOKA, 1962 Sagami Bay

* *Macroclinum* sp. HARTMEYER (1906) Zyôgasima

Subfamily Euherdmaniinae

38. *Placentela crystallina* REDIKORZEV, 1927 Okhotsk Sea
39. *Homoeodistoma michaelseni* REDIKORZEV, 1927 Kamchatka, Okhotsk Sea
40. *Homoeodistoma longigona* TOKIOKA, 1959 Off Minabe
41. *Pseudodistoma antinboja* TOKIOKA, 1949 Kii Sirahama
42. *Pseudodistoma fragilis* TOKIOKA, 1958 Sagami Bay
43. *Ritterella* (=*Sigillinaria*) sp. aff. *aequali-siphonis* (RITTER and FORSYTH), 1917 Hakodate
44. *Ritterella clavata* (OKA), 1933 Karahuto, Kamchatka
45. *Ritterella pedunculata* TOKIOKA, 1953 Sagami Bay

Family Didemnidae

46. *Didemnum* (*Didemnum*) *albidum* (VERRILL), 1871 Akkesi
47. *Didemnum* (*Didemnum*) *moseleyi* (HERDMAN), 1886 (=*Leptoclinum album* OKA, 1927) Sagami Bay, Ôsaka Bay, Sugasima, Sikoku Island, Kyûsyû Island, Wakasa Bay, Tokara Islands
48. ———— ———— f. *granulatum* TOKIOKA, 1954 Tokara Islands
49. ———— ———— f. *punici-color* TOKIOKA, 1954 Tokara Islands
50. *Didemnum* (*Didemnum*) *japonicum* (HERDMAN), 1886 Kôbe, Sagami Bay
51. *Didemnum* (*Didemnum*) *candidum* SAVIGNY, 1816 Tokara Islands
52. *Didemnum* (*Didemnum*) *dorotubu* nov. nom. for *Didemnum* (*Didemnum*) *fuscum* (OKA), 1931 (=*Hypurgon fuscum* OKA, 1931) Tateyama, Misaki, Hayama, Sagami Bay
53. *Didemnum* (*Didemnum*) *apersum* TOKIOKA, 1953 Sagami Bay, East China Sea
54. *Didemnum* (*Didemnum*) *misakiense* (OKA and WILLEY), 1892 (=*Sarcodidemnoides misakiense* OKA and WILLEY, 1892) Moroiso, Miura Peninsula, Pacific coast of Honsyû Island
55. *Didemnum* (*Didemnum*) *pacificum* TOKIOKA, 1953 Sagami Bay
56. *Didemnum* (*Didemnum*) *areolatum* TOKIOKA, 1953 Sagami Bay
57. *Didemnum* (*Didemnum*) *pardum* TOKIOKA, 1962 Sagami Bay

58. *Didemnum* (*Didemnum*) *tigrinoides* TOKIOKA, 1953 Onomiti
59. *Didemnum* (*Didemnum*) *translucidum* TOKIOKA, 1953 Sagami Bay, Kii Sirahama
60. *Didemnum* (*Didemnum*) *flagellatum* TOKIOKA, 1953 Sagami Bay
61. *Didemnum* (*Didemnum*) *partitum* TOKIOKA, 1953 Sagami Bay
**62. *Didemnum* (*Didemnum*) sp. Japanese waters
63. *Didemnum* (? *Didemnum*) *okudai* TOKIOKA, 1951 Akkesi
64. *Botrydemnum tenue* OKA, 1933 Tateyama, Misaki
65. *Didemnum* (*Polysyncraton*) *crassum* REDIKORZEV, 1913 Okhotsk Sea
66. *Didemnum* (*Polysyncraton*) *aspiculatum* TOKIOKA, 1949 (=*Didemnum* (*Polysyncraton*) *simaensis* TOKIOKA, 1949) Sagami Bay, Matoya Bay
67. *Didemnum* (*Polysyncraton*) *sagamiana* TOKIOKA, 1953 Sagami Bay
68. *Didemnum* (*Polysyncraton*) sp. aff. *arafurense* TOKIOKA, 1952 Sagami Bay
69. *Trididemnum tenerum* (VERRILL), 1871 Okhotsk Sea
70. *Trididemnum microzoa* (REDIKORZEV), 1913 (=*Didemnopsis microzoa* REDIKORZEV, 1913) Mamiya Straits
71. *Trididemnum savignii* (HERDMAN), 1886 Sagami Bay, Sado, Japanese waters
72. *Trididemnum* sp. aff. *savignii* var. *jolense* (VAN NAME), 1918 Ôsaka Bay
73. *Leptoclinides tigrinum* (OKA), 1927 (=*Didemnoides tigrinum* OKA, 1927) Pacific coast of Japan
74. *Leptoclinides komaii* TOKIOKA, 1949 Matoya Bay
75. *Leptoclinides ocellatus* (SLUITER), 1909 Sagami Bay
76. *Leptoclinides madara* TOKIOKA, 1953 Sagami Bay
77. *Leptoclinides nigrothorax* TOKIOKA, 1954 Ôsaka Bay
78. *Leptoclinides echinatus* TOKIOKA, 1954 Ôsaka Bay
79. *Leptoclinides rugosum* TOKIOKA, 1962 Sagami Bay, Sado
80. *Lissoclinum fragile* (VAN NAME), 1902 Tokara Islands
81. *Lissoclinum japonicum* TOKIOKA, 1958 Kii Sirahama
82. *Lissoclinum pulvinum* (TOKIOKA), 1954 (=*Didemnum* (*Didemnum*) *gottschaldti* TOKIOKA, 1950; *Didemnum* (*Didemnum*) *pulvinum* TOKIOKA, 1954) Tokara Islands
83. *Echinoclinum verrilli* VAN NAME, 1902 Sagami Bay
84. *Leptoclinum* (=*Diplosoma*) *mitsukurii* (OKA), 1892 (=*Leptoclinum okai* TOKIOKA, 1949; *Leptoclinum macrolobium* TOKIOKA, 1949) Pacific coast of Honsyû Island, Sagami Bay, Kii Sirahama, Matoya, Sado, Tokara Islands
85. *Leptoclinum takeharai* TOKIOKA, 1951 Otaru
86. *Leptoclinum midori* TOKIOKA, 1954 Tokara Islands
* *Leptoclinum* sp. HARTMEYER (1906) Hakodate, Nagasaki

Family Polycitoridae (=Clavelinidae)
Subfamily Clavelininae

87. *Podoclavella polycitorella* TOKIOKA, 1954 Tokara Islands

88. *Clavelina coerulea* OKA, 1934 Kagosima
89. *Clavelina fasciculata* VAN NAME, 1945 Sagami Bay
90. *Clavelina minuta* TOKIOKA, 1962 Sagami Bay
91. *Dendroclavella elegans* OKA, 1927 Tateyama, Sagami Bay

Subfamily Polycitorinae

92. *Eudistoma parvum* (OKA), 1927 (=*Distoma parvum* OKA, 1927) Japanese coasts
93. *Eudistoma sagamiana* TOKIOKA, 1953 Sagami Bay
94. *Eudistoma snakabri* TOKIOKA, 1954 Tokara Islands
95. *Eudistoma tokarae* TOKIOKA, 1954 Tokara Islands
96. *Eudistoma rubrum* TOKIOKA, 1954 Tokara Islands
97. *Eudistoma* sp. aff. *rubrum* TOKIOKA, 1954 Sado
98. *Eudistoma amploides* TOKIOKA, 1962 Sagami Bay

**99. *Eudistoma* sp. Japanese waters

100. *Archidistoma aggregatum* GARSTANG, 1891 Simoda
101. *Polycitor proliferus* (OKA), 1933 (=*Distoma proliferum* OKA, 1933; *Polycitor nutabilis* H. OKA, 1942) Tateyama, Misaki, Simoda, Sagami Bay, Sikine Island, Kii Sirahama, Keelung, Tokara Islands
102. *Cystodytes jodomi* OKA, 1929 South off Misaki

Subfamily Holozoinae

103. *Distaplia dubia* (OKA), 1927 (=*Leptobotrylloides dubium* OKA, 1927; *Distaplia japonica* TOKIOKA, 1951; *Distaplia yezoensis* TOKIOKA, 1951; *Distaplia imaii* HIRAI, 1952) Akkesi, Otaru, Onagawa, Sagami Bay, Ôsaka Bay
104. *Distaplia coronata* TOKIOKA, 1955 Simoda
105. *Distaplia systematica* TOKIOKA, 1958 Kii Sirahama
106. *Distaplia miyose* TOKIOKA, 1962 Sagami Bay

* *Distaplia* sp. HARTMEYER (1906) Yokohama

107. *Sycozoa* (=*Colella*) *kanzasi* (OKA), 1930 Sagami Bay, Pacific coast of Honsyû Island
108. *Cyathocormus mirabilis* OKA, 1912 Sagami Bay

* Polycitoridae form B TOKIOKA (1960) West coast of Kamchatka, Karahuto

Phlebobranchia (=Diktyobranchia)

Family Cionidae

Subfamily Diazoninae

109. *Rhopalaea crassa* (HERDMAN), 1880 (=*Rhopalaea sagamiana* OKA, 1927) Sagami Bay
110. *Rhopalaea mutuensis* OKA, 1927 Mutu Bay
111. *Rhopalaea macrothorax* TOKIOKA, 1953 Sagami Bay
112. *Rhopalaea* (=*Rhopalopsis*) *defecta* (SLUITER), 1904 Enosima
113. *Syndiazona grandis* OKA, 1926 Sagami Bay, Kii Sirahama, Off Minabe, Pacific coast of Honsyû Island, East China Sea

* *Aphanibranchion japonicum* OKA, 1906 Tateyama, Sagami Bay, Tyosen Strait

114. ———— ———— f. *discoides* TOKIOKA, 1949 Kii Sirahama

115. ———— ———— f. *irregularis* TOKIOKA, 1953 Sagami Bay

116. *Syndiazona chinensis* TOKIOKA, 1955 East China Sea

Subfamily Cioninae

117. *Ciona intestinalis* (LINNAEUS), 1767 Hokkaido, Mutu Bay, Matusima Bay, Yokohama, Kii Sirahama, Ôsaka Bay, Onomiti, Uwazima, Sikoku Island, Kyûsyû Island, Wakasa Bay, Sado

118. *Ciona indica* SLUITER, 1904 Izu Itô

119. *Ciona savignii* HERDMAN, 1882 Kôbe

120. *Ciona aspera* HERDMAN, 1886 Off Kôbe

Family Ascidiidae

Subfamily Perophorinae

121. *Perophora japonica* OKA, 1927 Akkesi, Otaru, Sagami Bay, Tateyama, Misaki, Tokusima, Kyûsyû Island, Ogasawara Islands

122. *Perophora sagamiensis* TOKIOKA, 1953 Sagami Bay

123. *Perophora listeri* var. *tokarae* TOKIOKA, 1954 Tokara Islands

124. *Perophora formosana* (OKA), 1931 (=*Ecteinascidia formosana* OKA, 1931; *Perophora bermudensis* BERRILL, 1932; *Perophora orientalis* ÄRNBÄCK, 1936) Misaki, Sagami Bay, Tokara Islands, Sado, Formosa, Pescadores

125. *Ecteinascidia tokaraensis* TOKIOKA, 1954 Tokara Islands

126. *Ecteinascidia jacerens* TOKIOKA, 1954 Tokara Islands

Subfamily Ascidiinae

127. *Ascidia prunum* MÜLLER, 1776 Tisima, Karafuto

128. *Ascidia callosa* STIMPSON, 1852 (=*Phallusia suensonii* TRAUSTEDT, 1885; *Phallusia koreana* TRAUSTEDT, 1885) Japan, Corean waters

129. *Ascidia obliqua* ALDER, 1863 Tisima, Karahuto

130. *Ascidia sydneiensis sydneiensis* (STIMPSON), 1855 (=*Ascidia sydneiensis* STIMPSON, 1855; *Phallusia longitubis* TRAUSTEDT, 1882) Hakodate, Sagami Bay

131. *Ascidia sydneiensis divisa* (SLUITER), 1898 (=*Ascidia divisa* SLUITER, 1898) Hakodate, Onagawa, Tokyo Bay, Izu Itô, Sagami Bay, Ôsaka Bay, Nagasaki

132. *Ascidia sydneiensis samea* (OKA), 1935 (=*Ascidia samea* OKA, 1935) Mutu Bay, Kesenuma, Matusima, Sagami Bay, Wakasa Bay, Sado

133. *Ascidia calcata* STIMPSON, 1855 Japan

134. *Ascidia granosa* SLUITER, 1904 Hakodate, Misaki

135. *Ascidia rhabdophora* SLUETER, 1904 Sagami Bay

136. *Ascidia aperta* SLUITER, 1904 Sikine Island, Tokara Islands

137. *Ascidia armata* HARTMEYER, 1906 Izu Itô, Aburatubo, Sagami Bay

138. *Ascidia longistriata* HARTMEYER, 1906 Misaki, Sagami Bay

139. *Ascidia dolosa* OKA, 1926 Gotô Islands

140. *Ascidia zara* OKA, 1935 Hokkaido, Mutu Bay, Kesenuma, Matusima Bay, Sagami Bay, Ôsaka Bay, Onomiti, Wakasa Bay, Kii Sirahama
141. *Ascidia ahodori* OKA, 1927 Hokkaido, Honsyû Island, Onomiti, Sado, Kyûsyû Island, Ariake-Kai
142. *Ascidia alpha* TOKIOKA, 1954 Ôsaka Bay, Onomiti
143. *Ascidia beta* TOKIOKA, 1954 Tokara Islands
144. *Ascidia gamma* TOKIOKA, 1954 Matusima Bay, Ôsaka Bay
145. *Ascidia matoya* TOKIOKA, 1949 Matoya Bay
146. *Ascidia sagamiana* TOKIOKA, 1953 Sagami Bay
147. *Ascidia zyogasima* TOKIOKA, 1962 Sagami Bay
**148. *Ascidia* sp. Japanese waters
149. *Ascidiella virginea* (MÜLLER), 1776 Nagasaki

Family Agnesiidae

150. *Agnesia himeboja* OKA, 1915 East coast of Honsyû Island, Tateyama, Matoya Bay, Nanao
151. *Agnesia sabulosa* OKA, 1929 Hakodate

Family Corellidae

Subfamily Rhodosomatinae

152. *Rhodosoma turcicum* (SAVIGNY), 1816 (=*Schizascus papillosus* STIMPSON, 1855; *Rhodosoma papillosum* f. *japonensis* OKA, 1932) Tokyo Bay, Sagami Bay, Uraga Channel, South off Misaki, Tosa, Ariake-Kai, Satuma

Subfamily Corellinae

153. *Corella japonica* HERDMAN, 1880 Onagawa Bay, Tokyo Bay, Yokohama, Sagami Bay, Kôbe, Miyazu, Sikoku Island, Pacific coast of Kyûsyû Island
154. *Corella japonica* var. *asamusi* OKA, 1927 Hakodate, Mutu Bay, Aomori-ken, Kesenuma, Matusima
155. *Corelloides molle* OKA, 1926 Middle part of the Bering Sea
156. *Chelyosoma macleayanum* BRODERIP and SOWERBY, 1830 Okhotsk Sea, Northern Tisima
157. *Chelyosoma inaequale* REDIKORZEV, 1913 Okhotsk Sea
158. *Chelyosoma ochotense* REDIKORZEV, 1911 Okhotsk Sea
159. *Chelyosoma orientale* REDIKORZEV, 1911 Mamiya Straits, Northern Tisima
160. *Chelyosoma yezoensis* OKA, 1928 Iburi
161. *Chelyosoma siboja* OKA, 1906 Hokkaido, Otaru, Zenibako, Mutu Bay, Aomori-ken, Northeastern part of Honsyû Island
162. *Chelyosoma sibogae* SLUITER, 1904 Sagami Bay
163. *Chelyosoma dofleini* HARTMEYER, 1906 Sagami Bay, Misaki
164. *Dicopia japonica* OKA, 1913 Near Kyûsyû Island
165. *Megalodicopia hians* OKA, 1918 Japan Sea, Sagami Bay

PLEUROGONA

Stolidobranchia (=Ptychobranchia)

Family Botryllidae

166. *Botryllus schlosseri* (PALLAS), 1766 Otaru, Sagami Bay
167. *Botryllus tuberatus* RITTER and FORSYTH, 1917 (=*Botryllus communis* OKA, 1927) Akkesi, Sagami Bay, Ôsaka Bay, Onomiti, Sado, Sikoku Island, Kyûsyû Island
168. *Botryllus magnicoecus* (HARTMEYER) 1912 (=*Polycyclus rufus* OKA, 1927; *Polycyclus niger* OKA, 1927) Sagami Bay, Kii Sirahama
169. *Botryllus primigenus* OKA, 1928 Akkesi, Tateyama, Sagami Bay, Ôsaka Bay
* *Botryllus* sp. HARTMEYER (1906) Sagami Bay
170. *Myxobotrus japonicus* OKA, 1931 Awazi Sumoto
171. *Botrylloides violaceus* OKA, 1927 (=*Botrylloides aurantium* OKA, 1927) Akkesi, Hakodate, Sagami Bay, Matoya, Ôsaka Bay, Onomiti, Wakasa Bay, Sado, Sikoku Island, Kyûsyû Island, Tokara Islands
* ———— ———— var. *nigra* OKA, 1927
* ———— ———— var. *rufescens* OKA, 1927
172. *Botrylloides tenue* OKA, 1927 Japanese coasts
173. *Botrylloides sulcatum* OKA, 1927 Japanese coasts
174. *Botrylloides molle* OKA, 1927 Kagosima
175. *Botrylloides carnosum* OKA, 1927 Japanese coasts
* *Botrylloides* sp. HARTMEYER (1906) Hakodate
176. *Sarcobotrylloides tatejamense*, OKA, 1927 Japanese coasts
177. *Psammobotrus purpureus* OKA, 1932 Tateyama

Family Styelidae

Subfamily Polyzoinae

178. *Symplegma reptans* (OKA), 1927 (=*Synstyela reptans* OKA, 1927) Sagami Bay, Kii Sirahama, Ôsaka Bay, Wakasa Bay, Sikoku Island, Kyûsyû Island
179. *Symplegma connectens* TOKIOKA, 1949 Sugasima, Onomiti
180. *Symplegma japonica* TOKIOKA, 1962 Sado
181. *Dictyostyela depressa* OKA, 1926 Japan
182. *Polyzoa vesiculiphora* TOKIOKA, 1951 Akkesi
183. *Polyzoa pacifica* TOKIOKA, 1951 Ôsaka Bay, Sado
184. *Polyzoa sagamiana* TOKIOKA, 1953 Sagami Bay
185. *Oculinaria* (*Syncarpa*) *oviformis* (REDIKORZEV), 1913 Okhotsk Sea

Subfamily Styelinae

186. *Polyandrocarpa* (*Eusynstyela*) *monotestis* TOKIOKA, 1953 Sagami Bay
187. *Polyandrocarpa* (*Polyandrocarpa*) *sagamiensis* TOKIOKA, 1953 Sagami Bay
188. *Polycarpa pedata* HERDMAN, 1881 Kii Sirahama
189. *Polycarpa cryptocarpa* (SLUITER), 1885 Izu Itô, Zyôgasima, Enosima, Sizahama, Satuma
190. *Polycarpa cryptocarpa* var. *kroboja* (OKA), 1906 Sagami Bay, Sikine Island, Kii Sirahama, Wakasa Bay, Sado

191. *Polycarpa japonica* MICHAELSEN, 1911 Satuma, Siza-hama
192. *Polycarpa döderleini* HARTMEYER, 1906 Sagami Bay
193. *Polycarpa döderleini* var. *siranuhi* TOKIOKA, 1960 Ariake-Kai
194. *Polycarpa maculata* HARTMEYER, 1906 Sagami Bay, Tango, Wakasa Bay
195. *Polycarpa granosa* TOKIOKA, 1953 Sagami Bay, Wakasa Bay
196. *Polycarpa takarazima* TOKIOKA, 1954 Tokara Islands
197. *Polycarpa psammotesta* TOKIOKA, 1953 Hakodate, Sagami Bay
198. *Cnemidocarpa rhizopus* (REDIKORZEV), 1907 Bering Sea
199. *Cnemidocarpa finmarkiensis* (KIAER), 1893 (=*Styela joannae* HERDMAN, 1898; *Styela elsa* HARTMEYER, 1906) Okhotsk Sea, Mamiy Straits, Northern coast of Japan Sea, Awazi-Okinose, Tagawa
200. *Cnemidocarpa areolata* (HELLER), 1878 Sagami Bay, Ôsaka Bay, Onomiti, Wakasa Bay, Sado, Tokara Islands
201. *Cnemidocarpa fertilis* (HARTMEYER), 1906 Sagami Bay, Japanese waters
202. *Cnemidocarpa fertilis* f. *minor* TOKIOKA, 1954 Matusima, Ôsaka Bay, Wakasa Bay
203. *Cnemidocarpa fertilis molguloides* (TOKIOKA), 1953 Sagami Bay
204. *Cnemidocarpa macrogastra* (OKA), 1935 Otaru, Mutu Bay, Sagami Bay, Ôsaka Bay, Onomiti, Hukui, Wakasa Bay
205. *Cnemidocarpa miyadii* TOKIOKA, 1949 (=*Cn. masuii* TOKIOKA, 1949) Matoya Bay, Hakata Bay
206. *Styela coriacea* (ALDER and HANCOCK), 1848 (=*Styela plata* OKA, 1930) Hokkaido, Otaru, Osyoro, Mutu Bay, Asamusi, Northern Part of Japan Sea
207. *Styela rustica* (LINNAEUS), 1767 (=*Vannamea kurilensis* OKA, 1932) Bering Sea, Okhotsk Sea, Northern Tisima, Mamiya Straits
208. *Styela macrenteron* RITTER, 1913 Bering Sea, Kamchatka, Okhotsk Sea
209. *Styela plicata* (LESUEUR), 1823 Yokohama, Sagami Bay, Kii Sirahama, Ôsaka Bay, Hukui, Mutu Bay, Sikoku Island, Kyûsyû Island, Nagasaki, Ariake-Kai
210. *Styela plicata* f. *tenuis* TOKIOKA, 1951 Ôsaka Bay
211. *Styela isibasii* TOKIOKA, 1951 Ôsaka Bay
212. *Styela longitubis* TRAUSTEDT and WELTNER, 1894 Yokohama
213. *Styela esther* HARTMEYER, 1906 Mutu Bay, Tokyo Bay, Sagami Hukuura, Sagami Bay, Wakasa Bay
214. *Styela irene* HARTMEYER, 1906 Miyazu
215. *Styela clara* HARTMEYER, 1906 Hakodate, Mutu Bay
216. *Styela cylindrica* (OKA), 1929 (=*Redikorzevia cylindrica* OKA, 1929) Iburi
217. *Styela partita* (STIMPSON), 1852 Yokohama, Sagami Bay, Ôsaka Bay, Onomiti, Sado, Ariake-Kai, Tokara Islands
218. *Styela sigma* HARTMEYER, 1906 Dôketsuba in Sagami Bay

219. *Styela atlantica* (VAN NAME), 1912 Sagami Bay, Japanese waters
220. ———— ———— f. *minor* TOKIOKA, 1953 Sagami Bay
221. *Styela aomori* OKA, 1935 Mutu Bay
222. *Styela monogamica* OKA, 1935 Mutu Bay
223. *Styela izuana* (OKA), 1934 (=*Molstyela izuana* OKA, 1934) Izu Itô
224. *Styela clavata* (PALLAS), 1774 Bering Sea, Northern Tisima, N. W. Pacific
225. *Styela clava* HERDMAN, 1881 Okhotsk Sea, Vladivostok, Wensan, Hokkaido, Hakodate, Akkesi, Mutu Bay, Same, Matusima, Sagami Bay, Ôsaka Bay, Wakaura, Tagawa, Kôbe, Onomiti, Miyazu, Wakasa Bay, Sikoku Island, Nagasaki, Kyûsyû Island
226. *Styela clava* var. *symmetrica* TOKIOKA, 1959 Sado, Kata
227. *Styela longipedata* TOKIOKA, 1953 Sagami Bay, Hukui
228. *Azygocarpa mutuensis* OKA, 1932 Mutu Bay
229. *Dendrodoa aggregata* (RATHKE), 1806 (=*Dendrodoa tuberculata* RITTER, 1899; *Dendrodoa subpedunculata* RITTER, 1899) Bering Sea, West coast of Kamchatka, Northern Tisima, Okhotsk Sea, Mamiya Straits, Peter the Great Bay, Akkesi, Mutu Bay
230. *Dendrodoa pulchella* (VERRILL), 1871 (=*Cynthia adolphi* KUPFFER, 1874; *Dendrodoa kükenthali* HARTMEYER, 1899) West coast of Kamchatka, Bering Sea, Mamiya Straits, Volcano Bay
231. *Dendrodoa lineata* (TRAUSTEDT), 1880 Bering Sea, Okhotsk Sea
232. *Dendrodoa microstigma* REDIKORZEV, 1916 Bering Sea
233. *Syndendrodoa composita* TOKIOKA, 1951 Akkesi
234. *Pelonaia corrugata* GOODSIR and FORBES, 1841 Bering Sea, Kamchatka, Mamiya Straists, Northern parts of Japan Sea

Family Pyuridae

235. *Pyura vittata* (STIMPSON), 1852 (=*Halocynthia karasboja* OKA, 1906) Hokkaido, Mutu Bay, Aomori-ken, Tateyama, Misaki, Sagami Bay, Sugasima, Kii Sirahama, Matuyama, Ariake-Kai
236. *Pyura sacciformis* (DRASCHE), 1884 (=*Cynthia sanderi* TRAUSTEDT and WELTNER, 1894; *Pyura aspera* TOKIOKA, 1949; *Pyura masuii* TOKIOKA, 1949) Yokohama, Miura Peninsula, Misaki, Sagami Bay, Tokyo Bay, Matoya Bay, Tagawa, Miyazu, Nagasaki
237. *Pyura japonica* (TRAUSTEDT), 1885 Japan
238. *Pyura michaelseni* (OKA), 1906 Mutu Bay, Ozika Peninsula, Kii Sirahama, Ôsaka Bay, Honsyû Island, Shikoku Island, Kyûsyû Island, Korea
239. *Pyura michaelseni* var. *depressa* TOKIOKA, 1949 Sugasima
240. *Pyura comma* (HARTMEYER), 1906 Misaki, Sagami Bay
241. *Pyura jokoboja* (OKA), 1906 Tateyama
242. *Pyura shiinoi* TOKIOKA, 1949 Sugasima
243. *Pyura snaboja* (OKA), 1926 Gotô Islands
244. *Pyura hystrix* (OKA), 1930 Sagami Bay

245. *Pyura trigamica* TOKIOKA, 1953 Sagami Bay
246. *Pyura lepidoderma* TOKIOKA, 1949 Sagami Bay, Matoya Bay, Ôsaka Bay, Onomiti, Wakasa Bay, Hukui, Ariake-Kai
247. *Pyura mirabilis* (v. DRASCHE), 1884 Hakodate, Misaki, West coast of Kii Peninsula, Ôsaka Bay, Wakasa, Honsyû Island, Awa, Sikoku Island, Misumi, Kyûsyû Island
248. *Pyura satsumensis* (STIMPSON), 1855 Japan
249. *Pyura delicatula* (STIMPSON), 1855 Tanegasima
250. *Herdmania momus* (SAVIGNY), 1816 (=*Cynthia pallida* HELLER, 1878; *Pyura pallida* f. *japonica* HARTMEYER, 1911) Tokyo Bay, Sagami Bay, Kii Sirahama, Wakasa, Hukui, Mozi, Kagosima
251. *Herdmania momus* f. *siphonalis* (OKA), 1933 Sagami Bay
252. *Boltenia ovifera* (LINNAEUS), 1767 Bering Sea, Okhotsk Sea, West coast of Kamchatka, Tisima, Karahuto
253. *Boltenia echinata* (LINNAEUS), 1767 (=*Cynthia arctica* HARTMEYER, 1899) Bering Sea, Okhotsk Sea, Mamiya Straits, Tisima, Karahuto, Northern coasts of Japan Sea, Akkesi, Hakodate
254. *Boltenia echinata* f. *iburi* (OKA), 1934 Iburi, Mutu Bay, Wakasa Bay, Ariake-Kai
255. *Boltenia isibasii* TOKIOKA, 1954 Ôsaka Bay
256. *Boltenia transversaria* (SLUITER), 1904 Ariake-Kai
257. *Halocynthia aurantium* (PALLAS), 1787 (=*Cynthia superba* RITTER, 1900; *Halocynthia aurantium* f. *koreana* HARTMEYER, 1903) Bering Sea, Okhotsk Sea, Aniva Bay, Vladivostok, Mamiya Straits, Tisima, Karahuto, Hokkaido, Otaru, Akkesi, Korea
258. *Halocynthia pyriformis* (RATHKE), 1806 Korean coasts
259. *Halocynthia hilgendorfi* (TRAUSTEDT), 1885 Hakodate, Tugaru Straits, Mutu Bay, Onagawa, Wakasa
260. ———— ———— f. *igaboja* OKA, 1906 Hokkaido, Otaru
261. ———— ———— f. *owstoni* OKA, 1906 Sagami Bay
262. ———— ———— f. *ritteri* OKA, 1906 Hatinohe, Northeastern part of Honsyû Island, Kinkwazan, Sado
263. *Halocynthia roretzi* (DRASCHE), 1884 Hokkaido, Otaru, Hakodate Mutu Bay, Aomori, Hatinohe, Isimaki, Oga Peninsula, Ozika Peninsula, Akita, Misaki, Tokyo Bay, Ôsaka Bay, Sikama, Hukui, Sado, Sikoku Island, Kysûyû Island
264. ———— ———— f. *typica* (OKA), 1926 Localities excluding Kyûsyû Island and the southern coast of Sikoku Island
265. ———— ———— f. *austrinus* TOKIOKA, 1953 (=var. *sikokiana*+var. *ivamiana* OKA, 1926) Japan Sea, Southern waters including the Inland Sea

266. *Halocynthia cactus* (OKA), 1932 Sagami Bay, Suruga Bay
267. *Halocynthia pachyderma* (OKA), 1926 Misaki
268. *Halocynthia simaensis* TOKIOKA, 1949 Sugasima
269. *Halocynthia igaguri* TOKIOKA, 1953 Onomiti
270. *Podocynthia turboja* OKA, 1929 Okisima in Sagami Bay, South off Misaki, Hukui
271. *Microcosmus polymorphus* HELLER, 1878 Izu Itô, Sagami Huku-ura, Zyôgasima
272. *Microcosmus hartmeyeri* OKA, 1906 Tateyama, Sagami Bay, Kii Peninsula, Wakasa, Honsyû Island
273. *Microcosmus multitentaculatus* TOKIOKA, 1953 Onomiti, Wakasa, Hukui, Ariake-Kai
274. *Microcosmus exasperatus* HELLER, 1878 (=*M. variegatus* HELLER, 1878) Formosa
275. *Microcosmus curvus* TOKIOKA, 1954 Tokara Islands
276. *Culeolus herdmani* SLUITER, 1904 Sagami Bay, Kii Channel
277. *Culeolus murrayi* HERDMAN, 1882 East off Japan

Family Molgulidae

278. *Gamaster japonicus* OKA, 1934 Sagami Bay, Hayama, Nanao
279. *Eugyrioides glutinans* (MOELLER), 1842 (=*Eugyrioides schmidti* REDIKORZEV, 1911; *Eugyrioides asamusi* OKA, 1930) Kishka Island, Peter the Great Bay, Asamusi, Sagami Bay, Matoya, Ôsaka Bay, Onomiti, Nanao
280. *Eugyrioides japonicum* OKA, 1929 Hakodate
281. *Eugyrioides hexarhiza* TOKIOKA, 1949 Matoya
* *Eugyra* sp. TOKIOKA (1951) Ôsaka Bay
282. *Pareugyrioides dalli* (RITTER), 1913 Bering Straits, Kishka and Attu Islands in the northern Pacific
283. *Pareugyrioides japonica* HARTMEYER, 1914 Peter the Great Bay
284. *Ctenicella undulata* TOKIOKA, 1949 Matoya
285. *Molgula griffithsii* (MACLEAY), 1825 (=*Molgula crystallina* (MÖLLER), 1842) Bering Sea, Kamchatka, Tisima, Korea
286. *Molgula griffithsii* var. *tuberculata* (REDIKORZEV), 1916 Okhotsk Sea, Mamiya Straits
287. *Molgula retortiformis* VERRILL, 1871 Okhotsk Sea, Awatshinskaja Bay
288. *Molgula pugetiensis* HERDMAN, 1898 Northern Pacific, Asamusi
289. *Molgula japonica* HARTMEYER, 1906 Tateyama, Yokohama
290. *Molgula redikorzevi* OKA, 1914 Okhotsk Sea, Northern parts of Japan Sea, Amur Bay, Mamiya Straits, Kamchatka, Akkesi
291. *Molgula rotunda* OKA, 1914 Kamchatka
292. *Molgula vannamei* OKA, 1914 Gotô Islands near Kyûsyû
293. *Molgula aidae* OKA, 1914 Sagami Bay, Matoya, Misumi

294. *Molgula hartmeyeri* OKA, 1914 Gotô Island near Kyûsyû
295. *Molgula xenophora* OKA, 1914 Hakodate, Hokuriku (Etigo), San'in (Izumo-saki)
296. *Molgula interrupta* TOKIOKA, 1953 Sagami Bay
297. *Molgula hozawai* OKA, 1932 Mutu Bay, Asamusi
298. *Molgula oligostriata* TOKIOKA, 1949 Matoya, Nanao
299. *Hartmeyeria orientalis* OKA, 1929 (=*Hartmeyeria longistigmata* TOKIOKA, 1949) Sagami Bay, Mozi, Kagosima, Matoya, Nanao (?Southern Karahuto)
300. *Rhizomolgula globularis* (PALLAS), 1776 Okhotsk Sea
301. *Rhizomolgula japonica* OKA, 1926 Japan Sea, Northern parts of the Pacific
302. *Hemirhizomolgula utidai* OKA, 1926 East coast of Karahuto

The five species on the list marked with two asterisks are new species whose descriptions and names are to be published in the Bulletin of the United States National Museum. Some of the listed species are described insufficiently, yet their types are inaccessible; and the validity of some other species is rather doubtful. When more crucial reexaminations are made, a considerable number of species may fall as synonyms of other valid species. On the other hand, it is expected that more new species or strangers will be found in our waters. Thus the list presented here is far from the completed check-list made after the careful examinations of specimens and literatures, but yet it can be accepted as showing the outline of Japanese ascidian fauna at the level of our present knowledge.

The species on the list can be sorted into the following four groups.

1) North cold water species. (The distribution is limited to the waters north of Hokkaido and Korea.).....73 species, 1 variety and 1 form.
2) Cosmopolitans. ..... 3 species.
3) North temperate-water species. (Being distributed widely in the waters surrounding four main islands of Japan.) .....152 species, one allied to a known species, 1 subspecies, 5 varieties and 13 forms.
4) Tropical-water species. (The distribution is limited to the waters south of the middle part of Honsyû Island.) .....49 species, 2 subspecies and 1 variety.

II. The outline of the ascidian fauna of the Pacific coasts of North America

The ascidian fauna of the Pacific coasts of North America can easily be summarized from VAN NAME's monumental work (1945), Ascidians of North and South Americas (Bull. American Mus. Nat. Hist., Vol. 84, 476 pp., 31 pls., 327

text-figs). After this book was published, two more taxonomic papers* appeared dealing with ascidians occurring on the Pacific coasts of this continent and one more species was added. Thus in all 114 taxa are known from the Pacific coasts north of the Equator. They contain 112 species, a subspecies and a variety as shown in List II, besides a single doubtful species.

List II

Ascidians from the Pacific coast of North America.

(Compiled on February 8, 1963)

ENTEROGONA

Aplousobranchia (=Krikobranchia)

Family Polyclinidae (=Synoicidae)

Subfamily Polyclininae

1. *Polyclinum laxum* VAN NAME, 1945 Gulf of California
2. *Polyclinum planum* (RITTER and FORSYTH), 1917 State of California, Lower California
3. *Aplidiopsis pannosum* (RITTER), 1899 Alaska, Pribilof Island
4. *Amaroucium californicum* RITTER and FORSYTH, 1917 Up to Vancouver

* *Amaroucium* sp. A HUNTSMAN (1912) Vancouver

* *Amaroucium* sp. B HUNTSMAN (1912) Vancouver

5. *Amaroucium solidum* RITTER and FORSYTH, 1917 San Diego to Monterey Bay
6. *Amaroucium propinquum* VAN NAME, 1945 Pacific Grove
7. *Amaroucium arenatum* VAN NAME, 1945 Pacific Grove, Dillon Beach
8. *Amaroucium spauldingi* (RITTER), 1907 California
9. *Amaroucium coei* RITTER, 1901 Alaska, Kodiak

* *Amaroucium figarium* RITTER, (MS.) California *Nomen nudum*

10. *Amaroucium translucidum* RITTER, 1901 Alaska, Pavlof Bay
11. *Synoicum par-fustis* (RITTER and FORSYTH), 1917 California

* *Synoicum* (?) sp. A HUNTSMAN (1912) Vancouver Island

* *Synoicum* (?) sp. B HUNTSMAN (1912) Vancouver Island

12. *Synoicum pellucidum* (RITTER and FORSYTH), 1917 La Jolla
13. *Synoicum irregulare* RITTER, 1899 Bering Sea, Alaska, Pribilof Group
14. *Synoicum jordani* (RITTER), 1899 Bering Sea, Bering Straits
15. *Synoicum kinkaidi* (RITTER), 1899 (=*Amaroucium pribilovense* RITTER, 1899; *Amaroucium snodgrassi* RITTER, 1899) Eastern part of the Bering Sea

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* BERRILL, N. J. and D. P. ABBOTT (1949): The structure of the ascidian, *Pycnoclavella stanleyi* n. sp., and the nature of its tadpole larva. Canadian Journal of Research, D. 27, pp. 43–49, 2 text-figs.

ABBOTT, D. P. (1961): The ascidians of Point Barrow, Alaska. Part I. Suborder Phlebobranchia (Enterogona). Pacific Science, Vol. 15, No. 1, pp. 137–143, 3 text-figs., 5 tables.

16. *Synoicum cymosum* REDIKORZEV, 1927 Bering Sea

Subfamily Euherdmaniinae

17. *Ritterella* (=*Sigillinaria*) *pulchra* (RITTER), 1901 Alaska to Northern California
18. *Ritterella aequali-siphonis* (RITTER and FORSYTH), 1917 California
19. *Euherdmania claviformis* (RITTER), 1903 California

Family Didemnidae

20. *Didemnum* (*Didemnum*) *albidum* (VERRILL), 1871 Bering Straits, St. Lawrence Island
21. *Didemnum* (*Didemnum*) *vanderhorti* VAN NAME, 1924 Panama Bay, Gulf of California
22. *Didemnum* (*Didemnum*) *santa-elenae* VAN NAME, 1945 Salinas near Punta Santa Elena, Ecuador
23. *Didemnum* (*Didemnum*) *carnulentum* RITTER and FORSYTH, 1917 Panama to Monterey Bay
24. *Didemnum* (*Didemnum*) *carnulentum* var. *lacteolum* RITTER and FORSYTH, 1917 San Diego
25. *Tridemnum opacum* (RITTER), 1907 (=*Tridemnum della vallei* RITTER and FORSYTH, 1917) Southern part of California coast
26. *Tridemnum tenerum* (VERRILL), 1871 Bering Straits
27. *Tridemnum strangulatum* (RITTER), 1901 Alaska
* *Tridemnum* sp. A HUNTSMAN (1912) Vancouver Island
* *Tridemnum* sp. B HUNTSMAN (1912) Vancouver Island
28. *Lissoclinum caulleryi* (RITTER and FORSYTH), 1917 South from San Diego
29. *Leptoclinum* (=*Diplosoma*) *pizoni* (RITTER and FORSYTH), 1917 California

Family Polycitoridae (=Clavelinidae)

Subfamily Clavelininae

30. *Clavelina fasciculata* VAN NAME, 1954 Gulf of California
31. *Clavelina huntsmani* VAN NAME, 1931 British Columbia to Northern half of California coast
32. *Pycnoclavella stanleyi* BERRILL and ABBOTT, 1949 Pacific Grove

Subfamily Polycitorinae

33. *Eudistoma pachecae* VAN NAME, 1945 Bay of Panama
34. *Eudistoma mexicanum* VAN NANE, 1945 Gulf of California
35. *Eudistoma diaphanes* RITTER and FORSYTH, 1917 California
36. *Eudistoma ritteri* VAN NAME, 1945 (=*Distoma y* RITTER, 1900 *nomen nudum*) California
* *Polycitor* (*Eudistoma*) sp. A HUNTSMAN (1912) Vancouver Island
* *Polycitor* (*Eudistoma*) sp. B HUNTSMAN (1912) Vancouver Island
37. *Eudistoma psammion* RITTER and FORSYTH, 1917 California
38. *Eudistoma molle* (RITTER), 1900 Pacific Grove to Puget Sound
39. *Cystodytes dellechiajei* (DELLA VALLE), 1877 Gulf of California

40. *Cystodytes lobatus* (RITTER), 1900 (=*C. cretaceus* VON DRASCHE by RITTER, 1907) California to British Columbia

Subfamily Holozoinae

41. *Distaplia occidentalis* BANCROFT, 1899 (=*D. confusa* RITTER, 1901; *Holozoa* sp. A HUNTSMAN, 1912; ? *Distaplia* sp. ÄRNBÄCK, 1929 from Chile) California to Kodiak (Alaska)

* *Holozoa* sp. B HUNTSMAN (1912) Vancouver Island

Phlebobranchia (=Diktyobranchia)

Family Cionidae

Subfamily Cioninae

42. *Ciona intestinalis* (LINNAEUS), 1767 Southern Alaska to Southern part of California
43. *Ciona mollis* RITTER, 1907 California, off San Nicolas Island

Family Ascidiidae

Subfamily Perophorinae

44. *Perophora annectens* RITTER, 1893 California

Subfamily Ascidiinae

45. *Ascidia prunum* O. F. MÜLLER, 1776 (=*Ascidiopsis nanaimoensis* HUNTSMAN, 1912) Arctic Seas, British Columbia
46. *Ascidia callosa* STIMPSON, 1852 (=*Ascidia adhaereus* RITTER, 1901; *Ascidiopsis columbiana* HUNTSMAN, 1912; *Ascidiella griffini* HERDMAN, 1898) Bering Sea, Alaska, British Columbia, Puget Sound
47. *Ascidia sydneiensis protecta* VAN NAME, 1945 Gulf of California
48. *Ascidia vermiformis* (RITTER), 1913 Southern California
49. *Ascidia ceratodes* (HUNTSMAN), 1912 (=*Ascidia californica* RITTER and FORSYTH, 1917; *Ascidia eiseni* MICHAELSEN, 1923) British Columbia to Chile
50. *Ascidia clementea* RITTER, 1907 California, off San Nicolas Island
51. *Ascidia paratropa* (HUNTSMAN), 1912 Alaska to Washington State
52. *Ascidia unalaskensis* (RITTER), 1913 Bering Sea

Family Agnesiidae

53. *Agnesia septentrionalis* HUNTSMAN, 1912 Bering Sea to the middle part of California

Family Corellidae

Subfamily Rhodosomatinae

54. *Rhodosoma turcicum* (SAVIGNY), 1816 Monterey Bay

Subfamily Corellinae

55. *Corella willmeriana* HERDMAN, 1898 (=*C. rugosa* HUNTSMAN, 1912; *C. inflata* HUNTSMAN, 1912) Southern parts of Alaska to Washington State
56. *Corellopsis pedunculata* HARTMEYER, 1903 Akutan Island of the Aleutian Chain, 72 fathoms
57. *Chelyosoma macleayanum* BRODERIP and SOWERBY, 1830 Bering Straits

58. *Chelyosoma productum* STIMPSON, 1864 British Columbia to Southern California
59. *Chelyosoma columbianum* HUNTSMAM, 1912 British Columbia to Washington State
60. *Chelyosoma inaequale* REDIKORZEV, 1913 Bering Straits, depths off Panama and California
61. *Corynascidia herdmani* RITTER, 1913 Bering Sea
62. *Benthascidia michaelseni* RITTER, 1907 Off Sam Diego, 2182 fathoms

PLEUROGONA

Stolidobranchia (=Ptychobranchia)

Family Botryllidae

63. *Botryllus tuberatus* RITTER and FORSYTH, 1917 Southern California
64. *Botrylloides aureum* SARS, 1851 (=*Botryllus magnus* RITTER, 1901) Alaska
65. *Botdylloides diegense* RITTER and FORSYTH, 1917 Southern California

Family Styelidae

Subfamily Polyzoinae

66. *Polyzoa translucida* RITTER and FORSYTH, 1917 San Diego
67. *Metandrocarpa dura* (RITTER), 1896 (=*Goodsiria dura* RITTER, 1896; *Metandrocarpa dermatina* HUNTSMAN, 1912) Southern part of California to British Columbia
68. *Metandrocarpa taylori* HUNTSMAN, 1912 (=*M. michaelseni* RITTER and FORSYTH, 1917) Southern California to British Columbia

Subfamily Styelinae

69. *Cnemidocarpa rhizopus* (REDIKORZEV), 1907 (=*Styela sabulifera* RITTER, 1913) Bering Bea, Kishka Island, Bristol Bay
70. *Cnemidocarpa finmarkiensis* (KIAER), 1893 (=*Styela stimpsoni* RITTER, 1900) Arctic and subarctic areas north from Puget Sound
71. *Cnemidocarpa drygalskii* (HARTMEYER), 1911 6°21′N×80°41′W off Panama, 1793 fathoms
72. *Styela coriacea* (ALDER and HANCOCK), 1848 (=*Goniocarp coccodes* HUNTSMAN, 1912; *G. lovenii* (SARS), 1851 and *G. placenta* (PACKARD), 1867 by HUNTSMAN, 1912; ? *Styela* sp. RITTER, 1913) Down to British Columbia
73. *Styela coriacea hemicaespitosa* RITTER, 1913 Bering Sea to Southern California
74. *Styela rustica* (LINNAEUS), 1767 Bering Sea
75. *Styela macrenteron* RITTER, 1913 Bering Sea
76. *Styela partita* (STIMPSON), 1852 Bay of Panama
77. *Styela milleri* RITTER, 1907 Depths off Southern California (2228, 1076, 868 and 1793 fathoms), Bay of Panama (581 fathoms), off Peru (2035 fathoms), and off Chile (449 fathoms)
78. *Styela barnharti* RITTER and FORSYTH, 1917 Gulf of California, Southern California

79. *Styela montereyensis* (DALL), 1872 British Columbia to Southern California
80. *Styla gibbsii* (STIMPSON), 1864 British Columbia to Southern California
81. *Styela truncata* RITTER, 1901 (=*Katatropa uclueletensis* HUNTSMAN, 1912; *Katatropa vancouverensis* HUNTSMAN, 1912) Southern Alaska, British Columbia, Middle part of California coast
82. *Styela clavata* (PALLAS), 1774 (=*Styela greeleyi* RITTER, 1899) Bering Sea, Aleutian Islands
83. *Styela yakutatensis* RITTER, 1901 Southern Alaska, Vancouver Island
84. *Dendrodoa aggregata* (RATHKE), 1806 Bering Sea, Alaska Peninsula, Aleutian Islands
85. *Dendrodoa pulchella* (VERRILL), 1871 Bering Straits, Nunivak Island of Alaska
86. *Dendrodoa (Styelopsis) grossularia* (VAN BENEDEN), 1846 St. Paul Island in the Bering Sea (RITTER, 1913)
87. *Pelonaia corrugata* GOODSIR and FORBES, 1841 British Columbia

Family Pyuridae

88. *Pyura bradleyi* VAN NAME, 1931 Santa Elena Bay, Ecuador
89. *Pyura lignosa* MICHAELSEN, 1908 Gulf of California, Pacific coast of Nicaragua
90. *Pyura haustor* (STIMPSON), 1864 (=*Cynthia erecta* RITTER, 1900; *Cynthia macrosiphonus* RITTER, 1900; *Halocynthia haustor foliacea* RITTER, 1913; ? *Halocynthia washingtonia* RITTER, 1913; *Halocynthia johnsoni* RITTER, 1909) Alaska to California
91. *Pyura mirabilis* (VON DRASCHE), 1884 (=*Microcosmus transversus*) RITTER, 1907) Washington State to California
92. *Boltenia ovifera* (LINNAEUS), 1767 Bering Sea
93. *Boltenia echinata* (LINNAEUS), 1767 (=*Ascidia hirsuta* AGASSIZ, 1850) Down to British Columbia
94. *Boltenia villosa* (STIMPSON), 1864 (=*Cynthia castaneiformis* VON DRASCHE, 1884) San Diego to British Columbia
95. *Halocynthia aurantium* (PALLAS), 1787 Bering Straits, Bering Sea, Puget Sound
96. *Halocynthia hilgendrofi* f. *igaboja* (OKA), 1906 (=*Halocynthia okai* RITTER, 1907) British Columbia to Santa Catalina of California
97. *Culeolus pyramidalis* RITTER, 1907 Depths off San Diego, 2228 and 2259 fathoms
98. *Culeolus sluiteri* RITTER, 1913 52°06′N×171°45′W, south of the Aleutian Islands, 283 fathoms
99. *Bathypera ovoida* (RITTER), 1907 Off San Nicolas Island of Southern California, 1000–1100 fathoms

Family Molgulidae

100. *Eugyrioides glutinans* (MOELLER), 1842 (=*Paramolgula rara* KIAER, 1896; *Paramolgula arctica* BONNEVIE, 1896) Down to Lower California
101. *Eugyra arenosa californica* VAN NAME, 1945 Del Mar of California
102. *Pareugyrioides dalli* (RITTER), 1913 Bering Straits, Alaska, Aleutian Islands
103. *Molgula griffithsii* (MACLEAY), 1825 (=*Clavelina chrystallina* MOELLER, 1842) Bering Straits, Aleutian Islands
104. *Molgula siphonalis* SARS, 1859 Pribilof Group
105. *Molgula occidentalis* TRAUSTEDT, 1883 Lower California, Gulf of California
106. *Molgula verrucifera* RITTER and FORSYTH, 1917 La Jolla
107. *Molgula regularis* RITTER, 1907 Southern California
108. *Molgula cooperi* (HUNTSMAN), 1912 British Columbia
109. *Molgula pugetiensis* HERDMAN, 1898 (=*Caesira apoploa* HUNTSMAN, 1912; ? *Caesira hecateia* HUNTSMAN, 1912) British Columbia, ? Southern California
110. *Molgula pacifica* (HUNTSMAN), 1912 British Columbia
111. *Molgula oregonia* RITTER, 1913 Alaska Peninsula, Pribilof Island, Oregon State
112. *Molgula retortiformis* VERRILL, 1871 Bering Sea, Alaska, Northern parts of North Pacific
113. *Hartmeyeria triangularis* RITTER, 1913 Alaska, Kishka Island of the Aleutian Islands
114. *Rhizomolgula globularis* (PALLAS), 1776 (=*R. arenaria* RITTER, 1901) Southeastern part of the Bering Sea to Prince William Sound

* ? *Psammaplidium pedunculatum* HERDMAN, 1899 (Australian species) reported by Ritter, 1901 from Sitka of Alaska.

Of course, the list includes doubtful or insufficiently described species and some ones might fall as synonyms of other distinctive species in future, although they must be much fewer than in the preceding case about Japanese ascidians. The species on the list can be divided into the following five groups.

1) North cold-water species. (Being distributed northerly to the waters surrounding Alaska and the islands of the Aleutian Chain.).....48 species, a subspecies and a questionable form.
2) Cosmopolitan.....a single species.
3) California Current forms. (The distribution does not reach Alaska.)..... 42 species and a variety.
4) Tropical-water species. (The distribution is limited to the waters south of the Southern California.).....20 species.
5) South cold-water species.....a single species.

III. Comparison between the western and eastern ascidian faunas of the North Pacific

i) *The richness of the fauna on the western side.*

Although the examination of synonymy has not yet been completed about Japanese ascidians and thus a certain number of species might be splitted into a good many species on the western side of the North Pacific, Japanese ascidian fauna may safely be estimated at least twice as large as that of the Pacific coasts of North America. If the area on the western side is extended south to the Equator as on the eastern side of the North Pacific, then the fauna will become amazingly much larger.

ii) *Amphi-Pacific species.*

There are 37 species common to both sides of the North Pacific as shown below.

List III

Species common to the Japanese waters and the Pacific coasts of North America.

*1. *Aplidiopsis pannosum*
*2. *Amaroucium translucidum*
*3. *Synoicum jordani*
*4. *Synoicum cymosum*
5. *Ritterella aequali-siphonis*
*6. *Didemnum (Didemnum) albidum*
*7. *Tridemnum tenerum*
**8. *Clavelina fasciculata*
9. *Ciona intestinalis*
*10. *Ascidia prunum*
*11. *Ascidia callosa*
**12. *Ascidia sydneiensis*
**13. *Rhodosoma turcicum*
*14. *Chelyosoma macleayanum*
*15. *Chelyosoma inaequale*
16. *Botryllus tuberatus*
*17. *Cnemidocarpa rhizopus*
*18. *Cnemidocarpa finmarkiensis*
*19. *Styela coriacea*
*20. *Styela rustica*
*21. *Styela macrenteron*
**22. *Styela partita*
*23. *Styela clavata*
*24. *Dendrodoa aggregata*

*25. *Dendrodoa pulchella*
*26. *Pelonaia corrugata*
27. *Pyura mirabilis*
*28. *Boltenia ovifera*
*29. *Boltenia echinata*
*30. *Halocynthia aurantium*
(*)31. *Halocynthia hilgendorfi* f. *igaboja*
*32. *Eugyrioides glutinans*
*33. *Pareugyrioides dalli*
*34. *Molgula griffithsii*
*35. *Molgula retortiformis*
*36. *Molgula pugetiensis*
*37. *Rhizomolgula globularis*

The species marked with an asterisk are north cold-water species and those with two asterisks are tropical species. *Ciona intestinalis* is a cosmopolitan, while *Ritterella aequali-siphonis*, *Botryllus tuberatus* and *Pyura mirabilis* are regarded as north temperate-water species on the western side and as occurring in the region affected by the California Current on the eastern side. *Halocynthia hilgendorfi* f. *igaboja* is treated in the Japanese waters as a cold-water form, although it is found in American waters in the California Current region.

Constitution of common species.

	Western side	Eastern side
North cold-water species	29	29−1*
Cosmopolitans	1	1
North temperate-water species	3	
California Current forms		3+1*
Tropical species	4	4

* *Halocynthia hilgendorfi* f. *igaboja*

It is evident that most of common species belong to the cold-water form; and they include a number of circum-polar species. In addition, there are about a dozen species on respective sides which have each one or more very closely allied partners on the opposite side. The ultimate distinction between respective coupled species is left for future crucial examinations.

List IV

Allied species occurring respectively in the Japanese waters and on the Pacific coasts of North America.

The Japanese waters	The Pacific coasts of North America
** *Polyclinum saturnium*	*Polyclinum luxum***

* *Aplidiopsis pannosum* * *Aplidiopsis helenae*	*Aplidiopsis pannosum**
* *Amaroucium glabrum* *Amaroucium* sp. (No. 21)	*Amaroucium californicum*
* *Synoicum jacobsoni* * *Synoicum derjugini* * *Synoicumjordani*	As. *S. pulmonaria* (ELLIS and SOLANDER, 1786) *Synoicum jordani**
Didemnum (Didemnum) moseleyi	*Didemnum (Didemnum) carnulentum* *Didemnum (Didemnum) carnulentum* var. *lacteolum*
** *Trididemnum savignii*	*Trididemnum opacum***
Leptoclinum mitsukurii	*Leptoclinum pizoni*
Perophora japonica	*Perophora annectens*
* *Ascidia callosa*	*Ascidia callosa** *Ascidia unalaskensis**
Corella japonica	*Corella willmeriana**
Botrylloides violaceus	*Botrylloides diegense*
Polyzoa vesiculiphora *Polyzoa pacifica*	*Polyzoa translucida*
Hartmeyeria orientalis	*Hartmeyeria triangularis**

*···cold-water species
**···tropical-water species

iii) *Dominance of the cold-water forms and meanness of the tropical forms on the eastern side.*

Generally speaking on the fauna of the American side, the cold-water form is the most dominant and followed by the California Current form, while on the Japanese side the most abundant is the north temperate-water species which is about twice as many as the north cold-water species.

Proportions of respective distributional groups shown as percent.

	Japanese side	American side
North cold-water species	25	43
Cosmopolitans	1	0.9
North temperate-water species	57	
California Current forms		37
Tropical species	17	17
South cold-water species	0	1

If the area is extended on the Japanese side to the Equator, then the proportion of the tropical species should increase tremendously.

On the eastern side, the developments of tropical species or groups seem to be much oppressed. The complete absence of any member of the subfamily

Diazoninae and the genera *Polycarpa* and *Microcosmus* and the poorness of the species of *Pyura* must be remarkable features showing this trend. As to the family Didemnidae which is evidently a group prospering in the tropical waters, there are seven genera comprising a lot of species on the western side, while only four genera are known on the eastern side and of course they include much fewer species here.

Genera of Didemnidae occurring on	
Japanese side	American side
Didemnum (*Didemnum*)	*Didemnum* (*Didemnum*)
Didemnum (*Polysyncraton*)	*Tridemnum*
Tridemnum	*Lissoclinum*
Leptoclinides	*Leptoclinum*
Lissoclinum	
Leptoclinum	
Echinoclinum	

Of three cosmopolitans, *Botryllus schlosseri* and *Styela plicata* are considered to be of the warm-water species, while *Ciona intestinalis* is rather of the cool-water species; and only the last occurs on the eastern side of the North Pacific, two warm-water members have not yet been found there. The south cold-water species found on the eastern side of the North Pacific is the Antarctic species *Cnemidocarpa drygalskii* (HARTMEYER), which was found from the depth off Panama, 6°21′N×80°41′W, 1793 fathoms. Moreover, the close resemblance between *Agnesia septentrionalis* HUNTSMAN, 1912 distributing from the Bering Sea to the middle part of California and *Agnesia glaciata* MICHAELSEN, 1898 from the Magellan Straits must be noted.

All the above-mentioned facts show the trend of the fauna on the eastern side to the cooler waters and this is very easily understood when the differences of the oceanographic conditions between Japanese and American sides of the North Pacific are noted. On the western side, the waters are affected by the Kurosio, a vigorous north flowing stream starting from the western tropical Pacific. The southern part of the area is protected by the Malay Archipelagoes and Australia from the influence of the cold water coming from the Antarctic Seas. On the contrary, on the eastern side of the North Pacific the California Current, a south flowing current of lower temperature, is flourishing to the southern boundary of the United States and there are no barriers to prevent the influence of the north flowing Humboldt Current starting in the Antarctic Seas. Moreover some slowly upwelled water may contribute to keep the water temperature a little lower along the coasts near the Equator on this side.

As to the tropical species, there are only four species common to the Pacific coasts of America and West Indies.

List V

Species common to the Pacific coasts of North America and West Indies.

1. *Cystodytes dellechiajei* (DELLA VALLE)
2. **Ascidia sydneiensis protecta* VAN NAME
3. *Rhodosoma turcicum* (SAVIGNY)
4. *Styela partita* (STIMPSON)

On the other hand, sixteen tropical species are known to be common to the Japanese waters and West Indies, besides two more species (those on the List VI marked with an asterisk) occur both in the Japanese waters and in the waters slightly north to West Indies, and moreover there are three couples of tropical species, one of each couple has the very closely related partner in so much remote locality.

List VI

Species common to the Japanese waters and West Indies.

1. *Polyclinum constellatum* SAVIGNY
2. *Didemnum (Didemnum) candidum* SAVIGNY
3. *Tridemnum savignii* (HERDMAN)
4. *Tridemnum savignii* var. *jolense* (VAN NAME)
5. *Lissoclinum fragile* (VAN NAME)
6. *Echinoclinum verrilli* VAN NAME
*7. *Archidistoma aggregatum* GARSTANG (North Carolina)
8. *Perophora formosana* (OKA)
9. *Ascidia sydneiensis* STIMPSON
10. *Rhodosoma turcicum* (SAVIGNY)
11. *Botryllus schlosseri* (PALLAS)
12. *Botryllus primigenus* OKA
13. *Styela plicata* (LESUEUR)
14. *Styela partita* (STIMPSON)
*15. *Styela atlantica* (VAN NAME) (From moderately deep water far off the coast of the middle U. S.)
16. *Pyura vittata* (STIMPSON)
17. *Herdmania momus* (SAVIGNY)
18. *Microcosmus exasperatus* HELLER

Three couples of tropical species occurring in the Japanese waters and West Indies.

Perophora listeri var. *tokarae* TOKIOKA .....*Perophora viridis* VERRILL
Ascidia rhabdophora SLUITER .....*Ascidia corelloides* VAN NAME
Symplegma japonica TOKIOKA.....*Symplegma viride* HERDMAN

It is rather curious that the Pacific coasts of America is much farther from West Indies than the Japanese waters, though this is attributable partly to the history of the differentiation and distribution of tropical ascidians and also to the differences of the oceanographic conditions between the eastern and western sides of the North Pacific and the history of the oceans as the similar phenomena might become known about many other animal groups. Lastly, the most strange fact to the present author is the quite absence of *Styela clava* in American waters, which is evidently a cool-water species and is capable of distributing widely by vessels as shown by the sudden appearance of the species in European waters in the latest decade*.

P.S. There are two more papers dealing with the ascidian fauna of the Pacific coasts of North America, which were missed to be referred in the present paper. One is my own paper—T. TOKIOKA (1960): Contributions to Japanese ascidian fauna. XVI. On some ascidians from the northern waters of Japan and the neighbouring subarctic waters. Publ. Seto Mar. Biol. Lab., VIII (1), pp. 191–194, Pls. XX and XXI. I don't know why this paper was overlooked, but this includes four ascidians from St. Lawrence Island. They are:

1. ?Polycitoridae form A
2. *Synoicum turgens* PHIPPS
3. *Synoicum pulmonaria* (ELLIS & SOLANDER)
4. *Styela macrenteron* RITTER.

As *Synoicum turgens* is closely allied to *S. irregulare* and *S. pulmonaria* is related to *S. jordani*, *S. jacobsoni* and *S. derjugini*, it is unlikely that this small collection contributed to increase the ascidian fauna of the Bering Sea.

The other paper is quite a new one—MCLAUGHLIN, P. A. (1963): Survey of the benthic invertebrate fauna of the eastern Bering Sea. U. S. Dept. Interior, Fish and Wildlife Service, Special Sci. Rep. Fisheries No. 401, 75 pp., 13 text-figs.—, in which are listed the following 12 ascidians identified by Dr. D. P. ABBOTT. These ascidians were collected in the waters north of Alaska Peninsula and all but *Aplidium* sp. are included in List II on pp. 144–149.

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* CARLISLE, D. B. (1954): *Styela mammiculata* n. sp., a new species of ascidian from the Plymouth area. J. mar. biol. Ass. U.K., Vol. 33, pp. 329–334.
TOKIOKA, T. (1955): Record of *Styela clava* HERDMAN from the European waters. Zool. Mag., Tokyo, Vol. 64, p. 200.
HOUGHTON, D. R. and R. H. MILLAR (1960): Spread of *Styela mammiculata* CARLISLE. Nature, London, Vol. 185, p. 862.
MILLAR, R. H. (1960): The identity of the ascidians *Styela mammiculata* CARLISLE and *S. clava* HERDMAN. J. mar. biol. Ass. U.K., Vol. 39, pp. 509–511.
WALLACE, H. (1961): The breeding and development of *Styela mammiculata* CARLISLE. J. mar. biol. Ass. U. K., Vol. 41, pp. 187–190.

1. *Aplidium* sp.
2. *Synoicum* sp.
3. *Trididemnum strangulatum* (RITTER)
4. *Trididemnum* sp. (? *tenerum*)
5. *Styela coriacea* (ALDER & HANCOCK)
6. *Styela macrenteron* RITTER
7. *Dendrodoa aggregata* (RATHKE)
8. *Dendrodoa pulchella* (VERRILL)
9. *Boltenia ovifera* (LINNAEUS)
10. *Halocynthia aurantium* (PALLAS)
11. *Molgula retortiformis* VERRILL
12. *Molgula* sp. 1 or 2